Ground Motion Simulations of Upper North Island Earthquakes

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More than 40% of NZ's population lives within 50 km of the Hauraki Rift. We have simulated ground motions at major population centres due to ruptures on structures within or near the rift. Our model incorporates a simple basin structure for the Hauraki rift. The main goal of this work is to identify gaps in knowledge that contribute uncertainty to the modelled hazard.

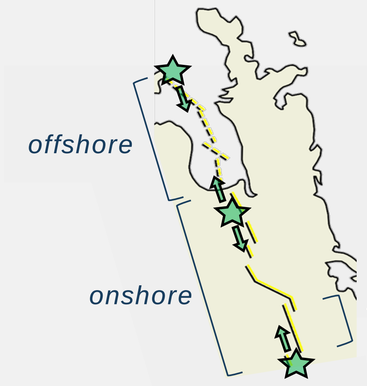
Wairoa North Fault

Single segment (M 6.7) scaling after *Leonard et al. (2010)* for 10 km thick seismogenic crust.

Directivity: S ⇨ N

No basin effects.

Kerepēhi Fault

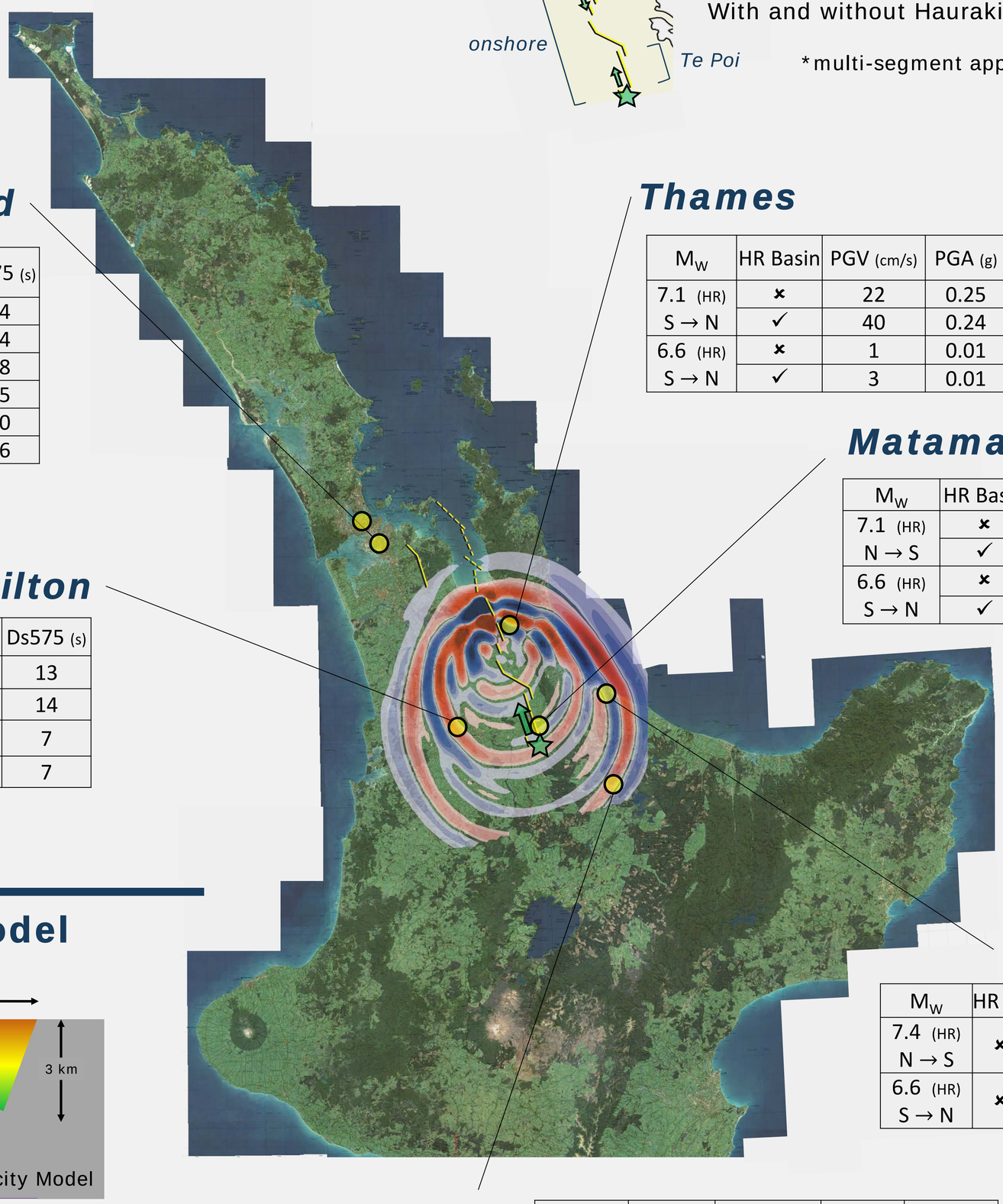


Te Poi segment (M 6.6), onshore segments* (M 7.1), onshore+offshore* (M 7.4) scaling after *Leonard et al. (2010)* for 10 km thick seismogenic crust.

Directivity: S ⇨ N, S ⇦ N, S ⇦ mid. ⇨ N

With and without Hauraki Rift Basin model.

*multi-segment approx. as effective single segment



Auckland

M_W	HR Basin		PGV (cm/s)	PGA (g)	Ds575 (s)
7.4 (HR) S → N	×	CBD	5	<0.01	6.4
		S AKL	6	0.01	7.4
	✓	CBD	8	0.09	5.8
		S AKL	15	0.12	7.5
6.7 (WF) S → N	-	CBD	5	0.08	5.0
		S AKL	31	0.26	1.6

*selected scenarios

Thames

M_W	HR Basin	PGV (cm/s)	PGA (g)	Ds575 (s)
7.1 (HR) S → N	×	22	0.25	1.7
	✓	40	0.24	2.7
6.6 (HR) S → N	×	1	0.01	8
	✓	3	0.01	18

Matamata

M_W	HR Basin	PGV (cm/s)	PGA (g)	Ds575 (s)
7.1 (HR) N → S	×	80	0.78	3.1
	✓	110	0.80	3.1
6.6 (HR) S → N	×	60	0.77	2.6
	✓	61	0.77	2.6

Hamilton

M_W	HR Basin	PGV (cm/s)	PGA (g)	Ds575 (s)
7.4 (HR) S → N	×	15	0.13	13
	✓	15	0.13	14
6.6 (HR) S → N	×	7	0.09	7
	✓	7	0.09	7

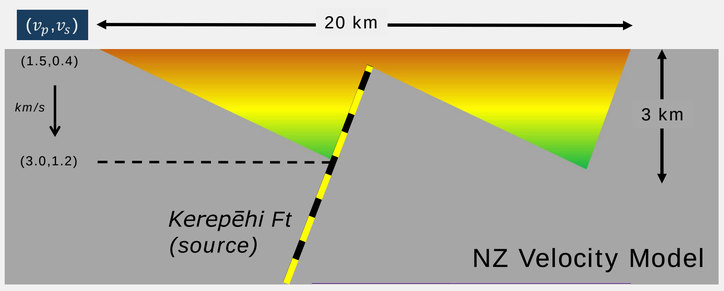
Tauranga

M_W	HR Basin	PGV (cm/s)	PGA (g)	Ds575 (s)
7.4 (HR) N → S	×/✓	11	0.11	9
6.6 (HR) S → N	×/✓	4	0.06	7.3

Rotorua

M_W	HR Basin	PGV (cm/s)	PGA (g)	Ds575 (s)
7.4 (HR) S → N	×/✓	13	0.10	8.6
7.4 (HR) N → S	×/✓	13	0.09	6.9
6.6 (HR) S → N	×/✓	4	0.04	10.7

Hauraki Rift Basin model



Findings and future directions

Matamata and Thames are most exposed to Kerepēhi Fault events. South Auckland is somewhat exposed to a Wairoa North Fault event. Basin effect amplifies ground motions in some places. In future, it would be helpful to introduce models of Tauranga, Waitemata, and Hamilton basins, and to further constrain the geometry and velocity structure of the Hauraki Rift. It would also be useful to understand whether multi-segment ruptures in the Hauraki Rift are possible. Finally, we will investigate other source-magnitude scaling relations, e.g., *Villamor et al. (2001)*.

QuakeCoRE
NZ Centre for Earthquake Resilience
Te Hiranga Rū

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